

12/PATS

TOOL RECEIVER FOR A GRINDER

Prior Art

The invention is based on a tool receiver for a grinder according to the preamble of claim 1.

A tool receiver for a grinder for a handheld angle grinder is made known in EP 0 904 896 A2. The angle grinder comprises a drive shaft that carries a thread on the tool side.

The tool receiver for a grinder comprises a carrier and a tensioning nut. To install a sanding disk, the carrier with an installation opening is pushed onto a collar of the drive shaft and tightened with positive engagement against a bearing surface via the tensioning nut. The carrier has a collar extending in the axial direction on the tool side that comprises radially-situated recesses on two opposite sides on its outer circumference that extend in the axial direction to a base of the collar. Starting at the recesses, one groove each extends around the outer circumference of the collar against the driving direction of the drive shaft. The grooves are closed against the driving direction of the drive shaft and taper axially starting at the recesses against the driving direction of the drive shaft.

The sanding disk comprises a hub having an installation opening in which two tongues point radially inward on opposite sides. The tongues can be inserted in the recesses in the axial direction and then in the grooves in the circumferential direction, against the driving direction. The sanding disk is immobilized in the grooves in the axial direction via the tongues with positive engagement and in the tapering contour of the grooves via non-positive engagement. During operation, the adhesion increases as a result of reaction forces acting on the sanding disk, which counteract the driving direction.

1 In order to prevent the sanding disk from spinning off of the carrier when the
2 brake is applied to the drive shaft, a stopper is located in the vicinity of a recess
3 on the circumference of the collar that is supported in an opening in a fashion
4 that allows it to move in the axial direction. In a working position with the sanding
5 disk pointing downward, the stopper is displaced axially in the direction of the
6 sanding disk by means of the force of gravity, closes the groove in the direction
7 of the recess, and blocks movement of the tongue located in the groove in the
8 driving direction of the drive shaft.

Advantages of the Invention

12 The invention is based on a tool receiver for a grinder, in particular for a
13 handheld angle grinder, having a carrier device via which an application tool can
14 be actively connected to a drive shaft.

16 It is proposed that the application tool be actively connectable to the carrier
17 device via at least one detent element movable against a spring force, which
18 detent element snaps into an operating position of the application tool and
19 immobilizes the application tool with positive engagement. Due to the positive
20 engagement, a high degree of reliability can be achieved, and a simple and cost-
21 effective, tool-free, rapid mounting system can be achieved. The application tool
22 can be reliably prevented from spinning off, even when the brake is applied to the
23 drive shaft, which can result in high brake torques.

25 The detent element can immobilize the application tool with positive engagement
26 directly or indirectly via an additional component, for example, via a locking lever
27 or plunger, etc. that is supported in a fashion that allows it to rotate and/or be
28 displaced axially and is coupled to the detent element. The detent element can
29 immobilize the application tool directly and/or indirectly with positive engagement
30 in various directions, such as in the radial direction, in the axial direction, and/or,
31 particularly advantageously, in the circumferential direction. It is also possible

1 that, due to the positive fixation of the application tool with the detent element in
2 a first direction, e.g, in the radial direction, the application tool is immobilized in a
3 second direction with positive engagement by means of a component separated
4 from the detent element.

5
6 The movable detent element can be designed in various forms appearing
7 practical to one skilled in the art, e.g., as an opening, projection, peg, bolt, etc.,
8 and it can be located on the application tool or on the carrier device.

9
10 Moreover, an advantageous encoding can be achieved by means of the positive
11 engagement, so that only specified application tools can be secured in the tool
12 receiver for a grinder. The carrier device can be designed at least partially as a
13 removable adapter part, or it can be connected with the drive shaft in non-
14 detachable fashion due to a non-positive, positive, and/or bonded connection.

15
16 Various application tools appearing practical to one skilled in the art can be
17 secured with the tool receiver for a grinder, such as application tools for
18 separating, grinding, roughing, brushing, etc. A tool receiver according to the
19 invention can also be used to secure a grinding plate of an eccentric grinding
20 machine.

21
22 The spring force can be designed to act in various directions, such as in the
23 circumferential direction or, particularly advantageously, in the axial direction,
24 whereby a solution can be achieved that is simple in design. The spring force can
25 further be used to immobilize the application tool in the circumferential direction
26 as well as in the axial direction.

27
28 In a further embodiment of the invention it is proposed that a drive torque be
29 transferrable via a positive connection between the application tool and the
30 carrier device. A high drive torque can be transferred reliably, and a drive torque
31 can be prevented from acting on a frictional connection.

1 As an advantage, the application tool can be connected to the carrier device via
2 a carrier element located on the application tool and/or the carrier device and
3 extending in the axial direction, that can be guided through at least one area of a
4 slot of the corresponding counter-element, displaced along the slot, and
5 immobilized in an end position by the detent element. Using the carrier element
6 extending in the axial direction, a securing in the circumferential direction and the
7 axial direction can be achieved, wherein the application tool is advantageously
8 immobilized with positive engagement in the axial direction via a transfer surface
9 of the carrier element. A high degree of reliability can be achieved and additional
10 components, weight, mounting effort, and costs can be achieved.

11
12 In one embodiment it is proposed that the detent element be formed by an
13 elastically deformable component, wherein additional spring elements are
14 spared, and simple, cost-effective designs can be achieved.

15
16 Advantageously, at least one detent element producing the spring force is
17 designed as an integral part of the tool hub of the application tool. The tool hub is
18 usually produced out of a relatively thin material that can be designed with a
19 simple construction that is elastically deformable. It is also feasible, however, that
20 at least one spring element is designed as an integral part of a component of the
21 carrier device, or it is formed by an additional component, wherein the tool hub
22 can be designed independent of a spring function.

23
24 In order to make a large spring deflection of the tool hub possible, at least one
25 recess is advantageously provided in a component of the carrier device forming a
26 bearing surface for the application tool, into which a part of the tool hub is
27 elastically pressed in an operating position of the application tool.

28
29 In a further embodiment of the invention it is proposed that the slot be provided in
30 the tool hub of the application tool, and that at least one detent element be
31 formed by a part of the tool hub in the vicinity of the slot; in fact, particularly

1 advantageously, the slot comprises a wide area and at least one narrow area
2 forming the detent element in front of an end position of the carrier element.
3 Simple, cost-effective and, in particular, essentially flat tool hubs can be achieved
4 that can be handled easily and in space-saving fashion during manufacture and
5 subsequent storage without the tool hubs interlocking on top of each other or with
6 other objects. In addition to a narrowed area, however, an axial raised part in the
7 tool hub forming the detent element would also be feasible in principle.

8
9 It is further proposed that at least one detent element is supported in a fashion
10 that allows it to move against a spring element. A large displacement of the
11 detent element during mounting of the application tool can be achieved by means
12 of the detent element supported in movable fashion, by way of which a large
13 overlap between two corresponding detent elements and a particularly reliable
14 positive connection can be achieved on the one hand and, on the other, a very
15 audible snap-in noise can be achieved that signals to the user in advantageous
16 fashion that the snap-in procedure was completed as desired.

17
18 The detent element can be designed to be movable in various directions against
19 a spring element, such as in the circumferential direction or, particularly
20 advantageously, in the axial direction, by way of which a simple design can be
21 achieved.

22
23 The detent element can even be supported in movable fashion in a component in
24 a bearing, e.g., in a flange of the carrier device or in a tool hub of the application
25 tool. Advantageously, the detent element can also be firmly connected to a
26 component supported in movable fashion in a bearing in non-positive, positive,
27 and/or bonded fashion, or it can be designed integrally connected with this, e.g.,
28 with a component supported on the drive shaft or a tool hub of the application
29 tool.

30

1 If the detent element can be released from its locked position using a release
2 button and, in particular, if it is movable against the spring element, the snap-in
3 connection can be reliably prevented from coming loose, e.g., by means of brake
4 torque, and safety can be increased. Operation of the application tool in two
5 circumferential directions can be made possible in principle, and comfort during
6 installation and removal of the application tool can be increased.

7

8 If the application tool is connected to the carrier device in the circumferential
9 direction via at least a first element and, in the axial direction via at least a
10 second element, simple and cost-effective tool hubs can be achieved that can
11 advantageously be designed flat in shape. An interlocking of the tool hubs during
12 manufacture and storage can be prevented, and good handling of the application
13 tool with its tool hubs can be achieved. Moreover, the components can be
14 advantageously designed for their function, i.e., either for immobilization in the
15 circumferential direction or immobilization in the axial direction. The elements can
16 be formed by a component or, advantageously, by separate components. The
17 tool hubs can be designed simply and advantageously with a closed centering
18 hole, and a low-vibration movement of the application tool can be achieved.
19 Moreover, by selecting a suitable diameter for the centering hole, it can be
20 ensured that application tools provided for the tool receiver for a grinder
21 according to the invention can be secured to traditional grinders via heretofore
22 known fastening devices, and, in fact, via fastening devices in particular with
23 which the application tool can be immobilized on the drive shaft with a tensioning
24 nut and a tensioning flange against a bearing surface in the axial direction with
25 positive engagement and, in the circumferential direction, via non-positive
26 connection.

27

28 Moreover, at least one detent element extending in the axial direction can
29 advantageously be snapped into place in a recess of a tool hub of the application
30 tool corresponding to the detent element in an operating position of the
31 application tool in the axial direction, and the application tool can be immobilized

with positive engagement in the circumferential direction. Using a means of attaining the object of the invention having a simple design, an advantageous positive connection can be achieved in a circumferential direction and, preferably, in both circumferential directions. The detent element extending in the axial direction can be formed by a separate bolt or an integrally-moulded peg that is produced by means of a deep-drawing procedure, etc.

If at least one detent element is integrally-moulded to a discoid component and/or if at least two elements for immobilizing the application tool in the axial direction are integrally-moulded to a discoid component, additional components, mounting effort, and costs can be spared. Moreover, compression connections between individual components and weak points resulting therefrom can be avoided.

Drawing

Further advantages result from the following drawing description. Exemplary embodiments of the invention are presented in the drawing. The drawing, the description, and the claims contain numerous features in combination. One skilled in the art will also advantageously consider the features individually and combine them into further practical combinations.

Figure 1 is an angle grinder shown from above,
Figure 2 is a driving flange shown from below,
Figure 3 is the driving flange in Figure 2 shown in a side view,
Figure 4 is a tool hub of a cutoff wheel shown from below,
Figure 5 is an enlarged view along the line V-V in Figure 4,
Figure 6 is a variant of Figure 3,
Figure 7 is a variant of Figure 4,
Figure 8 is a sectional view along the line VIII-VIII in Figure 1 through an alternative carrier device,

- 1 Figure 9 is a tool hub shown from below,
- 2 Figure 10 is a variant of Figure 8,
- 3 Figure 11 is an exploded diagram of a variant of Figure 8,
- 4 Figure 12 is a tool hub from Figure 11 shown from above,
- 5 Figure 13 is a sectional view along the line XIII-XIII in Figure 12,
- 6 Figure 14 is a release button from Figure 11 shown from below,
- 7 Figure 15 is a sectional view along the line XV-XV in Figure 14,
- 8 Figure 16 is a carrier element from Figure 11 shown from below,
- 9 Figure 17 is a carrier element from Figure 16 shown from the side,
- 10 Figure 18 is a sectional view along the line XVIII-XVIII in Figure 16,
- 11 Figure 19 is an exploded diagram of a variant of Figure 10,
- 12 Figure 20 is a sectional view through a carrier disk in Figure 19 with integrally-
- 13 moulded bolts,
- 14 Figure 21 is a side view of a sheet-metal plate in Figure 19, and
- 15 Figure 22 is a driving flange in Figure 19 shown from below.

16

17 Figure 1 shows an angle grinder 10 from above having an electric motor—not
 18 shown in greater detail—located in a housing 96. The angle grinder 10 can be
 19 guided via a first handle 98 extending in the longitudinal direction and integrated
 20 in the housing 96 opposite to a cutoff wheel 18 and via a second handle 102
 21 extending at an angle to the longitudinal direction secured to a drive housing 100
 22 in the vicinity of the cutoff wheel 186.

23

24 Using the electric motor, a drive shaft 54 can be driven via a gear mechanism,
 25 not shown in greater detail, on its end pointing toward the cutoff wheel 186 of
 26 which a carrier device 182 is located (Figures 2 and 3).

27

28 The carrier device 182 comprises a driving flange 256. The driving flange 256 is
 29 screwed into place on the drive shaft 54 via a thread 258 and, with a face 260
 30 pointing in the direction 44 opposite to the cutoff wheel 186, extends to a collar
 31 262 on the drive shaft 54. It would also be possible to connect a driving flange

1 with a drive shaft in non-detachable fashion, or to design it integrated with a drive
2 shaft. Three driving pins 202, 204, 206 are pressed into the driving flange 256
3 that extend in the axial direction 38 over an axial bearing surface 264 of the
4 driving flange 256 for the cutoff wheel 186, and that are evenly spaced in the
5 circumferential direction. Heads are integrally-moulded on the driving pins 202,
6 204, 206 on the ends pointing toward the cutoff wheel 186. The head has a
7 larger diameter than the remaining part of the driving pin 202, 204, 206 and
8 forms a support surface 278 in the direction of the driving flange 256. A centering
9 hole 266 for the cutoff wheel 186 extending in the axial direction 38 is integrally-
10 moulded in the bearing surface 264.

11
12 The cutoff wheel 186 comprises a sheet-metal hub 228 (Figure 4). The sheet-
13 metal hub 228 comprises a centering hole 268, via which the cutoff wheel 186
14 can be centered on the centering collar 266 of the driving flange 256. The sheet-
15 metal hub 228 is connected and pressed to a grinding means 114 via a riveted
16 joint, which is not shown in greater detail. The sheet-metal hub 228 comprises
17 three slots 214, 216, 218 evenly spaced in the circumferential direction 34, 36,
18 each of which comprises a wide area 244, 246, 248 produced by means of a
19 bore hole, and a narrow area 270, 272, 274 extending in the circumferential
20 direction 36.

21
22 A part of the sheet-metal hub 228 is designed as a spring shackle on one end of
23 the slot 214, 216, 218 opposite to the wide area 244, 246, 248, which spring
24 shackle forms a detent element 190, 192, 194. Instead of spring shackles
25 integrally-moulded to the sheet-metal hub 228, spring-mounted driving pins could
26 also be attached to the driving flange.

27
28 When the cutoff wheel 186 with its sheet-metal hub 228 is placed on the driving
29 flange 256, the heads of the driving pins 202, 204, 206 are inserted through the
30 wide areas 244, 246, 248 of the slots 214, 216, 218. The sheet-metal hub 228 is
31 oriented with its centering hole 268 over the centering flange 266. By rotating the

1 sheet-metal hub 228 relative to the driving flange 256 against the driving
2 direction 34, the spring shackles or the detent elements 190, 192, 194 move
3 under the heads of the driving pins 202, 204, 206. The direction of rotation 36 for
4 securing the cutoff wheel 186 is opposite to the driving direction 34 of the drive
5 shaft 54. This ensures that the cutoff wheel 186 does not unintentionally come
6 loose during operation. The heads of the driving pins 202, 204, 206 glide over the
7 lugs 276 of the spring shackles or the detent elements 190, 192, 194 when
8 rotated, and displace them in the axial direction 44 toward the driving flange 256.
9 When the heads have passed the lugs 276 or an operating position of the cutoff
10 wheel 186 has been reached, the spring shackles spring back partially in the
11 axial direction 38 and grip behind the heads with positive engagement. A snap-in
12 noise produced thereby can serve to ensure the operator that the sheet-metal
13 hub 228 is locked in place as desired. A remaining tension or spring force of the
14 spring shackles presses the cutoff wheel 186 against the bearing surface 264
15 without play in the axial direction 44.

16
17 The drive torque of the electric motor is transferred from the driving flange 256
18 with positive engagement via the driving pins 202, 204, 206 and via the spring
19 shackles or via the detent elements 190, 192, 194 to the sheet-metal hub 228. A
20 brake torque that is produced and opposes the drive torque is transferred with
21 positive engagement from the heads of the driving pins 202, 204, 206 via the
22 lugs 276 of the detent elements 190, 192, 194 to the sheet-metal hub 228, and
23 with frictional engagement from the bearing surface 264 to a corresponding
24 bearing surface of the sheet-metal hub 228. The magnitude of the friction force
25 thereby depends on the surface condition of the two bearing surfaces 264 and a
26 clamping force of the spring shackles, and can be adjusted accordingly via these
27 parameters. The cutoff wheel 186 is reliably prevented from spinning off. So as to
28 transfer particular high brake torques, a Velcro connection or another type of
29 positive-engagement connection can be created between the bearing surfaces,
30 for example.

31

1 To remove the cutoff wheel 186, the cutoff wheel 186 is rotated in the driving
2 direction 34 relative to the driving flange 256 so that the heads of the driving pins
3 202, 204, 206 glide over the lugs 276 of the detent elements 190, 192, 194.
4 When the driving pins 202, 204, 206 come to rest in the wide areas 244, 246,
5 248 of the slots 214, 216, 218, the cutoff wheel 186 can be removed from the
6 driving flange 256 in the axial direction 38.

7
8 An alternative carrier device 184 having a corresponding cutoff wheel 188 is
9 shown in Figures 6 and 7. Components that essentially remain the same are
10 basically labelled with the same reference numerals in the exemplary
11 embodiments shown. Moreover, the description of the exemplary embodiment in
12 Figures 1 through 5 can be referred to for the exemplary embodiment in Figures
13 6 and 7.

14
15 The carrier device 184 comprises a driving flange 234. Three driving pins 208,
16 210, 212 are pressed into the driving flange 234, which extend in the axial
17 direction 38 over an axial bearing surface 232 of the driving flange 234 for the
18 cutoff wheel 188, and are spaced evenly in the circumferential direction 34, 36.
19 Heads are integrally-moulded with the driving pins 208, 210, 212 on their ends
20 pointing toward the cutoff wheel 188. The head has a larger diameter than the
21 remaining part of the driving pin 208, 210, 212 and forms a conical, tapering
22 transfer surface 226 in the axial direction 44 toward the driving flange 234.
23 Recesses 236 are provided in the bearing surface 232 in the vicinity of the
24 driving pins 208, 210, 212.

25
26 The cutoff wheel 188 comprises a sheet-metal hub 230 (Figure 7). The sheet-
27 metal hub 230 comprises a centering hole 268, via which the cutoff wheel 188
28 can be centered on a centering collar 266 of the driving flange 234. The sheet-
29 metal hub 230 is connected and pressed to a grinding means 144 via a riveted
30 joint, which is not shown in greater detail. The sheet-metal hub 230 contains
31 three slots 220, 222, 224 evenly spaced in the circumferential direction 34, 36,

1 each of which comprises a wide area 238, 240, 242 produced by means of a
2 bore hole, and a narrow area, each of which forms a detent element 196, 198,
3 200, in front of an end position 250, 252, 254 of the driving pins 208, 210, 212.
4

5 When the cutoff wheel 188 with its sheet-metal hub 230 is placed on the driving
6 flange 234, the heads of the driving pins 208, 210, 212 are inserted through the
7 wide areas 238, 240, 242 of the slots 220, 222, 224. The sheet-metal hub 230 is
8 oriented with its centering hole 268 over the centering collar 266. When the
9 sheet-metal hub 230 is rotated against the driving direction 24 relative to the
10 driving flange 234, the driving pins 208, 210, 212 move in the curved slots 220,
11 222, 224. The direction of rotation 36 for securing the cutoff wheel 188 is
12 opposite to the driving direction 34 of the drive shaft 54. This ensures that the
13 cutoff wheel 188 does not unintentionally come loose during operation.
14

15 When the sheet-metal hub 230 is rotated, the heads of the driving pins 208, 210,
16 212 glide with their conical transfer surfaces 226 over the narrowed areas or over
17 the detent elements 196, 198, 200 of the slots 220, 222, 225, each of them
18 thereby pressing part of the sheet-metal hub 230 axially in the recesses 236 of
19 the bearing surface 232 of the driving flange 234 provided for this in the vicinity of
20 the slots 220, 222, 224 in the direction 44 of the driving flange 234. When the
21 cutoff wheel 188 has reached an operating position, or when the driving pins 208,
22 210, 212 have reached their end position 250, 252, 254 having a width slightly
23 larger than the middle area of the slots 220, 222, 224, the detent elements 196,
24 198, 200 snap into place behind the heads of the driving pins 208, 210, 212 with
25 positive engagement. In the end positions 250, 252, 254, the sheet-metal hub
26 230 is displaced elastically by a defined amount by the conical transfer surfaces
27 226 of the driving pins 208, 210, 212. A remaining elastic clamping force of the
28 sheet-metal hub 230 presses this against the bearing surface 232. The sheet-
29 metal hub 230 is secured without play in the axial direction 38, 44 with positive
30 engagement.

1 The drive torque of the electric motor is transferred from the driving flange 234
2 with positive engagement via the driving pins 208, 210, 212 at the end of the
3 slots 220, 222, 224 to the sheet-metal hub 230. A brake torque that is produced
4 and opposes the drive torque is transferred with positive engagement from the
5 heads of the driving pins 208, 210, 212 via the detent elements 196, 198, 200 to
6 the sheet-metal hub 230, and with frictional engagement from the bearing
7 surface 232 to a corresponding bearing surface of the sheet-metal hub 230. The
8 magnitude of the friction force thereby depends on the surface condition of the
9 two bearing surfaces 232 and a clamping force of the detent elements 196, 198,
10 200, and can be adjusted accordingly via these parameters. The cutoff wheel
11 186 is reliably prevented from spinning off.

12
13 To remove the cutoff wheel 188, the cutoff wheel 188 is rotated in the driving
14 direction 34 relative to the driving flange 234 so that the heads of the driving pins
15 208, 210, 212 glide over the detent elements 196, 198, 200. When the driving
16 pins 208, 210, 212 come to rest in the wide areas 238, 240, 242 of the slots 220,
17 222, 224, the cutoff wheel 188 can be removed from the driving flange 234 in the
18 axial direction 38.

19
20 Figure 8 shows a sectional view along the line VIII-VIII in Figure 1 through a
21 carrier device 12 that is an alternative to Figure 2. The carrier device 12
22 comprises a driving flange 82 pressed solidly to a side of a drive shaft 54 facing a
23 cutoff wheel 18 and a driving disk 56 supported on the drive shaft 54 in such a
24 fashion that it can be displaced axially against a coil spring 20 located in the
25 center.

26
27 Three pins 40 are pressed into the driving flange 82 that extend in the axial
28 direction 38 toward the cutoff wheel 18 over the driving flange 82 and that are
29 evenly spaced in the circumferential direction 34, 36. Each of the pins comprises
30 a head on its end pointing toward the cutoff wheel 18 that has a larger diameter
31 compared to a remaining part of the pin 40, and, on a side facing the driving

flange 82, a conical support surface 76 tapering in the axial direction 44. The driving flange 82 forms an axial bearing surface 80 for the cutoff wheel 18 that establishes an axial position of the cutoff wheel 18 and in which recesses 84 are provided in the vicinity of the pins 40. Moreover, three axial through holes 104 are provided in the driving flange 82 that are evenly spaced in the circumferential direction 34, 36; in fact, one through hole 104 each is located between two pins 40 in the circumferential direction.

Three bolts 24 are pressed in the driving disk 56 supported on the drive shaft 54 in axially displaceable fashion, which extend in the axial direction 38 toward the cutoff wheel 18 over the driving disk 56 and are evenly spaced in the circumferential direction 34, 36. The driving disk 56 is pressed against the driving flange 82 by the coil spring 20 in the direction 38 toward the cutoff wheel 18. The bolts 24 extend through the through holes 104 and extend in the axial direction 38 over the driving flange 82.

Moreover, the carrier device 12 comprises a release button 28 designed in the shape of a pot, located in the middle, on the side facing the cutoff wheel 18. The release button 28 comprises three segments 106 evenly spaced in the circumferential direction 34, 36 and extending in the axial direction 44 toward the axially movable driving disk 56 that grip through corresponding recesses 108 of the driving flange 82 and are connected to the driving disk 56 in the axial direction 38 via a circlip 110 secure the release button 28 from falling out. The release button 28 is inserted in displaceable fashion into a ring-shaped recess 112 in the driving flange 82 in the axial direction 38, 44.

The cutoff wheel 18 comprises a sheet-metal hub 52 that is solidly connected and pressed to a grinding means 114 via a riveted joint which is not shown in greater detail (Figure 9). The tool hub could also be produced out of another material appearing practical to one skilled in the art, such as plastic, etc. The sheet-metal hub 52 comprises three sequential holes 46, 48, 50 in the

1 circumferential direction 34, 36, the diameter of which is slightly greater than the
2 diameter of the bolts 24. Moreover, the sheet-metal hub 52 comprises three slots
3 64, 66, 68 located in sequence in the circumferential direction 34, 36 and
4 extending in the circumferential direction 34, 36, each of which comprises a
5 narrow area 70, 72, 74 and a wide area 58, 60, 62 produced by means of a bore
6 hole, the diameter of which is slightly larger than the diameter of the heads of the
7 pins 40.

8
9 The sheet-metal hub 52 comprises a centering hole 116, the diameter of which is
10 advantageously selected so that the cutoff wheel 18 can also be mounted on a
11 traditional angle grinder using a traditional mounting system with a mounting
12 flange. A "downward compatibility" is ensured.

13
14 When mounting the cutoff wheel 18, the cutoff wheel 18 is slid with its centering
15 hole 116 onto the release button 28 and centered radially. The cutoff wheel 18 is
16 then rotated until the pins 40 grip in the wide areas 58, 60, 62 of the slots 64, 66,
17 68 of the sheet-metal hub 52 provided for this. By pressing the sheet-metal hub
18 52 against the bearing surface 80 of the driving flange 82, the bolts 24 in the
19 through holes 104 and the driving disk 56 are displaced against a spring force of
20 the coil spring 20 on the drive shaft 54 axially in the direction 44 opposite to the
21 cutoff wheel 18.

22
23 Rotating the sheet-metal hub 52 further against the driving direction 34 displaces
24 the pins 40 in the curved narrow areas 70, 72, 74 of the slots 64, 66, 68. The pins
25 40 thereby press with their conical support surfaces 76 on the edges of the slots
26 64, 66, 68, and press them elastically into the recesses 84 of the driving flange
27 82. The sheet-metal hub 52 is thereby pressed against the bearing surface 80
28 and immobilized in the axial direction 38, 44.

29
30 In a final operating position of the cutoff wheel 18, the holes 46, 48, 50 come to
31 rest in the sheet-metal hub 52 via the through holes 104 of the driving flange 82.

1 The bolts 24 are displaced axially in the direction 38 of the cutoff wheel 18 by
2 means of the spring force of the coil spring 20, snap into place in the holes 46,
3 48, 50 of the sheet-metal hub 52, and immobilize them with positive engagement
4 in both circumferential directions 34, 36. When they snap into place, a snap-in
5 noise audible to the operator is produced which signals to the operator that the
6 tool is ready to use.

7

8 A drive torque of the electric motor of the angle grinder 10 can be transferred to
9 the cutoff wheel 18 from the drive shaft 54 to the driving flange 82 with non-
10 positive engagement, and from the driving flange 82 via the bolts 24 with positive
11 engagement. The drive torque is transferred exclusively via the bolts 24, because
12 the slots 64, 66, 68 are designed so that the pins 40 do not come to rest at the
13 narrow end 70, 72, 74 of the slots when the bolts 24 are snapped into place.
14 Moreover, a brake torque occurring during and after the electric motor is
15 switched off and that is opposed to the drive torque can be transferred with
16 positive engagement by the driving flange 82 to the cutoff wheel 18 via the bolts
17 24. The cutoff wheel 18 is reliably prevented from unintentionally coming loose.
18 An advantageous, even distribution of forces and mass is achieved by means of
19 the three bolts 24 evenly spaced in the circumferential direction 34, 36.

20

21 The release button 28 is pressed to release the cutoff wheel 18 from the angle
22 grinder 10. The driving disk 56 is thereby displaced with the bolts 24 via the
23 release button 28 against the coil spring 20 in the axial direction 44 opposite to
24 the cutoff wheel 18, whereby the bolts 24 move in the axial direction 44 out of
25 their locked position or out of the holes 46, 48, 50 of the sheet-metal hub 52. The
26 cutoff wheel 18 is then rotated in the driving direction 34 until the pins 40 come to
27 rest in the wide areas 58, 60, 62 of the slots 64, 66, 68 and the cutoff disk 18 can
28 be removed from the driving flange 82 in the axial direction 38. After the release
29 button 28 is released, the driving disk 56, the bolts 24, and the release button 28
30 are pushed back to their initial positions by means of the coil spring 20.

1 An exemplary embodiment with a carrier device 14 that is an alternative to the
2 exemplary embodiment in Figure 8 is shown in Figure 10. Figures 8 and 9 can be
3 referred to with regard for features and functions that remain the same.

4
5 The carrier device 14 comprises a driving flange 90 pressed onto the drive shaft
6 54. A collar 92 is integrally-moulded to a driving flange 90 forming a bearing
7 surface 88 for the cutoff wheel 18, via which collar 92 the cutoff wheel 18 is
8 centered radially in its state with the centering hole 116 mounted. Radial forces
9 can be advantageously absorbed by the driving flange 90 without stressing the
10 release button 28.

11
12 In order to immobilize the cutoff wheel 18, moreover, three pins 42 spaced
13 evenly in sequence in the circumferential direction 34, 36 and extending in the
14 axial direction 38 over the bearing surface 88 are supported in the driving flange
15 90 in a fashion that allows them to be displaced in the axial direction 38 against
16 one disk spring 86 in each case. Each of the pins 42 comprises a head on its end
17 pointing toward the cutoff wheel 18 that has a larger diameter than a remaining
18 portion of the pin 42 and has a conical transfer surface 78 tapering in the axial
19 direction 44 on a side facing the driving flange 90, and a support surface 78a
20 extending in parallel to the bearing surface 88. When the heads of the pins 42
21 are inserted through the wide areas 58, 60, 62 of the slots 64, 66, 68, rotating the
22 sheet-metal hub 52 against the driving direction 34 causes the pins 42 to be
23 displaced into the curved narrow areas 70, 72, 74 of the slots 64, 66, 68. The
24 pins 42 are therefore displaced axially over the conical transfer surfaces 78
25 against the pressure of the disk spring 86 in direction 38 until the support
26 surfaces 78a of the pins 42 overlap the edges of the slots 64, 66, 68 in the
27 curved narrow areas 70, 72, 74.

28
29 In the installed state, the disk springs 86 press the cutoff wheel 18 against the
30 bearing surface 88 via the support surfaces 78a of the pins 42. Instead of a
31 plurality of disk springs 86, the pins can also be loaded via a common spring

1 element, e.g., via a disk spring extending over the entire circumference and not
2 shown in greater detail. The exemplary embodiment shown in Figure 10 having
3 the pins 42 supported in axially displaceable fashion is suited in particular for
4 thick and/or only slightly elastically deformable tool hubs.

5
6 Figures 11 through 18 show a further exemplary embodiment having a carrier
7 device 16. The carrier device 16 comprises a driving flange 118 secured to a
8 drive shaft—not shown in greater detail—via a thread 120 (Figure 11, Figures 16,
9 17, and 18). The driving flange could also be designed connected to the drive
10 shaft via a non-detachable connection, or it could be designed as an integral part
11 with this.

12
13 The driving flange 118 comprises three segments 122, 124, 126 and
14 intermediate spaces 128, 130, 132 between them located in sequence in the
15 circumferential direction 34, 36 and extending in the axial direction 38 to a cutoff
16 wheel 32 (Figure 16). Each of these segments 122, 124, 126 comprises a groove
17 134, 136, 138 on its circumference that is closed against the driving direction 34
18 in each case via a rotary stop 140, 142, 144 and is open in the driving direction
19 34. Moreover, the driving flange 118 comprises a bearing surface 180 that
20 establishes an axial position of the cutoff wheel 32. Moreover, the segments 122,
21 124, 126 form a centering collar for the cutoff wheel 32, via which the cutoff
22 wheel 32 can be centered.

23
24 In the installed state, a detent element 26 is connected to the driving flange 118
25 via three snap-in pegs 146, 148, 150 spaced around the circumference, that grip
26 through corresponding recesses 158, 160, 162 of the driving flange 118 and grip
27 radially outward behind the driving flange 118 (Figures 11, 14, and 15). Three
28 locking segments 152, 154, 156 located in sequence in the circumferential
29 direction 34, 36 and extending radially outward are integrally-moulded to the
30 detent element 26, which also forms a release button 30. A coil compression
31 spring 22 is located between the driving flange 118 and the detent element 26,

1 against which the detent element 26 can be displaced relative to the driving
2 flange 118 in the axial direction 44 opposite to the cutoff wheel 32. The detent
3 element 26 is thereby guided over radially outwardly-pointing bearing surfaces
4 164, 166, 168 between the locking segments 152, 154, 156 in radially inwardly-
5 pointing surfaces of the segments 122, 124, 126 of the driving flange 118. To
6 prevent the detent element 26 from tilting and to achieve small bearing surfaces
7 164, 166, 168, the bearing surfaces 164, 166, 168 are formed by projections 170
8 extending radially outward (Figure 14).

9

10 In the installed state, the locking segments 152, 154, 156 are located in the
11 intermediate spaces 128, 130, 132 of the driving flange 118 and extend radially
12 over a groove bottom of the grooves 134, 136, 138. In an initial position before
13 installation of the cutoff wheel 12, the locking segments 152, 154, 156 of the
14 detent element 26 lie in front of the grooves 134, 136, 138, loaded by the
15 preloaded coil compression spring 22, in fact.

16

17 The cutoff wheel 32 comprises a ring-shaped sheet-metal hub 94 that is press-
18 moulded with a grinding means 114 on its outer diameter and comprises tongues
19 or spring elements 172, 174, 176 pointing radially outward on its internal
20 diameter (Figures 11, 12, and 13). The spring elements 172, 174, 176, in
21 combination with the driving flange 118 and the release button 30, serve to
22 transfer the drive torque, to axially position the cutoff wheel 32, and to secure the
23 cutoff wheel 32 from spinning off when the electric motor is switched on or when
24 the brake is applied to the drive shaft. Moreover, the spring elements, in addition
25 to the segments 122, 124, 126, can be used to center the cutoff wheel 32 to the
26 drive shaft.

27

28 When the cutoff wheel 32 is installed, it is oriented on the driving flange 118 in
29 such a fashion that the spring elements 172, 174, 176 on the internal diameter of
30 the sheet-metal hub 94 point into the intermediate spaces 128, 130, 132 between
31 the segments 122, 124, 126 on the driving flange 118. The spring elements 172,

1 174, 176 of the cutoff wheel 32 lie on the locking segments 152, 154, 156 of the
2 release button 30. The cutoff wheel 32 is then pressed in the axial direction until
3 it reaches the bearing surface 180 of the driving flange 118. The spring elements
4 172, 174, 176 displace the release button 30 with their locking segments 152,
5 154, 156 against the spring force of the coil compression spring 22 in the
6 direction 44 axially opposite to the cutoff wheel 32. The locking segments 152,
7 154, 156 are pressed into recesses 178 of the driving flange 118 (Figure 18) so
8 that the spring elements 172, 174, 176 come to rest in front of the grooves 134,
9 136, 138.

10

11 The cutoff wheel 32 is thereby centered radially via the centering collar formed by
12 the segments 122, 124, 126. When the cutoff wheel 32 is turned against the
13 driving direction 34, the spring elements 172, 174, 176 grip into the grooves 134,
14 136, 138 of the driving flange 118. A spring-groove connection is established.
15 The spring elements 172, 174, 176 comprise the length of the grooves 134, 136,
16 138 in the circumferential direction 36. If the spring elements 172, 174, 176 are
17 pushed into the grooves 134, 136, 138 completely, or if an operating position of
18 the cutoff disk 32 is reached, the detent element 26 snaps into place with its
19 locking segments 152, 154, 156, wherein the coil compression spring 22 presses
20 the detent element 26 with its locking segments 152, 154, 156 into its initial
21 position, so that the locking segments 152, 154, 156 come to rest in front of the
22 grooves 134, 136, 138 once more. The detent element 26, with its locking
23 segments 152, 154, 156, immobilizes the cutoff wheel 32 against the driving
24 direction 34 with positive engagement.

25

26 A snap-in noise that is audible to the operator is produced during the snap-in
27 procedure that signals to the user that the snap-in procedure was completed as
28 desired and the tool is ready to use.

29

30 The drive torque is transferred with positive engagement via the rotary stops 140,
31 142, 144 of the driving flange 118 to the spring elements 172, 174, 176 of the

1 sheet-metal hub 94 or the cutoff wheel 32. The cutoff wheel 32 is centered via
2 the centering collar formed by the segments 122, 124, 126 of the driving flange
3 118 and is held in its axial position by means of the bearing surface 180 and the
4 grooves 134, 136, 138. Moreover, a brake torque occurring during and after the
5 the electric motor is switched off that opposes the drive torque is transferred with
6 positive engagement from the locking segments 152, 154, 156 and the driving
7 flange 118 to the spring elements 172, 174, 176 of the cutoff wheel 32.

8
9 A compensation for play is achieved in the axial direction by means of a spring
10 element—not shown in greater detail—formed by a metal strip in the grooves
11 134, 136, 138. Moreover, a compensation for play could be achieved via other
12 spring elements appearing practical to one skilled in the art, such as via spring-
13 loaded balls that are located in suitable locations of the driving flange and that
14 immobilize the tool hub of the cutoff wheel without play, and/or via a slight
15 oversizing of the spring elements of the tool hub, by means of a slightly wedge-
16 shaped form of the grooves and the spring element of the tool hub, etc.

17
18 To release the cutoff wheel 32, the release button 30 is pressed in the axial
19 direction 44 opposite to the cutoff wheel 32. The locking segments 152, 154, 156
20 of the release button 30 or the detent element 26 are pushed into the recesses
21 178 of the driving flange 118. The cutoff wheel 32 can then be rotated in the
22 driving direction 34 with its spring elements 172, 174, 176 out of the grooves 134,
23 136, 138 of the driving flange 118 and removed in the axial direction 38. When
24 the cutoff wheel 32 is removed, the release button 30 is pressed back into its
25 initial position by the coil compression spring 22.

26
27 An exemplary embodiment having a carrier device 300 that is an alternative to
28 the exemplary embodiment in Figure 10 is shown in Figure 19. The carrier device
29 300 comprises a driving flange 90 that forms a bearing surface 88 for a cutoff
30 wheel that is not shown in greater detail. A collar 92 is integrally moulded to the
31 carrier flange 90 on the side facing the cutoff disk, via which the cutoff disk is

1 centered radially with its centering hole in the installed state. Radial forces can
2 be advantageously absorbed by the driving flange 90 without stressing the
3 release button 28.

4
5 A sheet-metal plate 308 having three integrally-moulded fastening elements 306
6 extending in the axial direction 38 and spaced evenly in the circumferential
7 direction are located on a side of the driving flange 90 opposite to the cutoff
8 wheel to lock the cutoff wheel in place axially. The fastening elements 306 are
9 integrally-moulded to the sheet-metal plate 308 in a bending procedure.

10
11 During installation, the driving flange 90, an ondular washer 312, and the sheet-
12 metal plate 308 are preassembled. The ondular washer 312 is thereby slid onto a
13 collar 322 of the driving flange 90 pointing in the direction opposite to the cutoff
14 wheel. The fastening elements 306 of the sheet-metal plate 308, which comprise
15 a hook-shaped extension on its exposed end with an angled surface 310 pointing
16 in the circumferential direction (Figures 19 and 21), are guided in the axial
17 direction 38 through recesses 314 in the driving flange 90, in fact, each of them
18 through widened areas 316 of the recesses 314 (Figures 19 and 21). By
19 compressing and rotating the sheet-metal plate 308 and the driving flange 90
20 against each other, the ondular washer 312 is preloaded, and the sheet-metal
21 plate 308 and the driving flange 90 are connected with positive engagement in
22 the axial direction 38, 44, in fact, by the hook-shaped extensions rotating in
23 narrow areas 318 of the recesses 314 (Figures 19, 21, and 22). The sheet-metal
24 plate 308 is then supported, loaded by the ondular washer 312, on the bearing
25 surface 88 of the driving flange 90 via edges 310a of the hook-shaped
26 extensions that point axially in the direction opposite to the cutoff wheel.

27
28 After the sheet-metal plate 308 with the integrally-moulded fastening elements
29 306, the ondular washer 312, and the driving flange 90 are preassembled, a
30 compression spring 20 and a driving disk 304 having three integrally-moulded
31 bolts 302 extending in the axial direction 38 and spaced evenly around the

circumference are slid onto a drive shaft 54. The bolts 302 are integrally-moulded to a sheet-metal plate forming the driving disk 304 in a deep-drawing process (Figure 20).

The preassembled assembly consisting of the sheet-metal plate 308, the ondular washer 312 and the driving flange 90 are then mounted on the drive shaft 54. During installation, the bolts 302 are guided through recesses 320 integrally-moulded on the circumference of the sheet-metal plate 308 and through through holes 104 in the driving flange 90 and grip through the through holes 104 in the installed state. The sheet-metal plate 308 and the driving flange 90 are secured via the bolts 302 against rotating in relation to each other.

The driving flange 90 is pressed onto the drive shaft 54 and then secured with a retaininer ring not shown in further detail. In addition to a compression connection, other connections appearing practical to one skilled in the art are also feasible, such as a threaded connection, etc.

When, during mounting of a cutoff wheel 18 (refer to Figures 8 and 10), the hook-shaped extensions of the fastening elements 306 are guided through the wide areas 58, 60, 62 of the slots 64, 66, 68 of the sheet-metal hub 52 (Figure 19), rotating the sheet-metal hub 52 against the driving direction 34 causes the hook-shaped extensions to be pushed into the curved, narrow areas 70, 72, 74 of the slots 64, 66, 68 of the sheet-metal hub 52. In doing so, the sheet-metal plate 308 with the fastening elements 306 is displaced axially via the angled surfaces 310 against the pressure of the ondular washer 312 in direction 38 until the edges 310a of the hook-shaped extensions come to rest in curved, narrow areas 70, 72, 74 laterally next to the slots 64, 66, 68 of the sheet-metal hub 53. In the installed state, the ondular washer 312 presses the cutoff wheel 18 against the bearing surface 88 via the edges 310a of the hook-shaped extensions.

1 As an alternative, the fastening elements and the slots can be designed rotated
2 by 180° in the sheet-metal hub, so that the mounting direction reverses, and the
3 sheet-metal hub is rotated in the driving direction during mounting. If the
4 fastening elements are designed rotated by 180°, an angled surface of a lower
5 front edge of the fastening element leads during operation, so that injuries by a
6 front edge can be prevented.

7

8

9

10

11

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13

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Reference Numerals

1

2

10	Angle grinder	56	Component
12	Carrier device	58	Area
14	Carrier device	60	Area
16	Carrier device	62	Area
18	Application tool	64	Slot
20	Spring element	66	Slot
22	Spring element	68	Slot
24	Detent element	70	Area
26	Detent element	72	Area
28	Release button	74	Area
30	Release button	76	Seating surface
32	Application tool	78	Transfer surface
34	Circumferential direction	80	Bearing surface
36	Circumferential direction	82	Component
38	Direction	84	Recess
40	Fastener	86	Spring element
42	Fastener	88	Bearing surface
44	Direction	90	Component
46	Recess	92	Collar
48	Recess	94	Tool hub
50	Recess	96	Housing
52	Tool hub	98	Handle
54	Drive shaft	100	Drive housing

3

1

102	Handle	152	Locking segment
104	Through hole	154	Locking segment
106	Segment	156	Locking segment
108	Recess	158	Recess
110	Circlip	160	Recess
112	Recess	162	Recess
114	Grinding means	164	Bearing surface
116	Centering hole	166	Bearing surface
118	Driving flange	168	Bearing surface
120	Thread	170	Projection
122	Segment	172	Spring element
124	Segment	174	Spring element
126	Segment	176	Spring element
128	Intermediate space	178	Recess
130	Intermediate space	180	Bearing surface
132	Intermediate space	182	Carrier device
134	Groove	184	Carrier device
136	Groove	186	Application tool
138	Groove	188	Application tool
140	Rotary stop	190	Detent element
142	Rotary stop	192	Detent element
144	Rotary stop	194	Detent element
146	Snap-in peg	196	Detent element
148	Snap-in peg	198	Detent element
150	Snap-in peg	200	Detent element

2

3

1

202 Carrier element
 204 Carrier element
 206 Carrier element
 208 Carrier element
 210 Carrier element
 212 Carrier element
 214 Carrier element
 216 Slot
 218 Slot
 220 Slot
 222 Slot
 224 Slot
 226 Transfer surface
 228 Component
 230 Component
 232 Bearing surface
 234 Component
 236 Recess
 238 Area
 240 Area
 242 Area
 244 Area
 246 Area
 248 Area
 250 End position
 252 End position
 254 End position
 256 Driving flange

2

3

258 Thread
 260 Face
 262 Collar
 264 Bearing surface
 266 Centering collar
 268 Centering hole
 270 Area
 272 Area
 274 Area
 276 Lug
 278 Seating surface

 300 Carrier device
 302 Detent element
 304 Component
 306 Element
 308 Component
 310 Angled surface
 310a Edge
 312 Spring element
 314 Recess
 316 Area
 318 Area
 320 Recess
 322 Collar